Bank Leverage, Capital Requirements and the Implied Cost of (Equity) Capital

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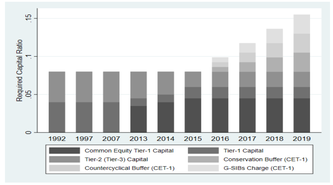
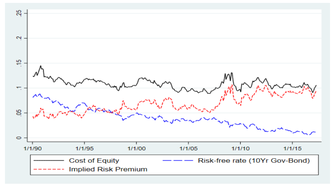
1 Introduction

"The expectation of the market for a ten percent return as the cost of capital was there when the risk-free rate of interest was five percent. And today when the rate of interest is zero, it is the same ten percent when we have more than double the capital, and so [are] consequently much less risky" (Lloyd Blankfein)

- **Bank Capital Regulation**
  - The global financial crisis triggered significant changes in capital requirements via Basel III
  - Better capitalized banks might be desirable from a *social* perspective
- **Bank Cost of Equity**
  - Increased capital requirements could inflict ***private*** costs on banks
  - Relying more on equity financing could increase banks' cost of capital leading to higher lending rates
- **Modigliani-Miller (MM)**
  - Government guarantees represent further distortions, not present in other industries





2 Methodology

- **Computing the Implied Cost of (Equity) Capital**
  - Defined as the discount rate that equates an asset's market value to the present value of future cash flows, i.e.

$$P_t = \sum_{k=1}^{\infty} \frac{\mathbb{E}_t[CF_{t+k}]}{(1+ICC)^k}$$

  - Five different empirical implementations are employed and the implied risk premium (IRP) computed as

$$IRP_{i,t} = ICC_{i,t} - r_t$$

- **Fixed-Effects Panel Regression**
  - MM WACC formula is rearranged to estimate the correlation between leverage and the cost of equity

$$IRP_{i,t} = \alpha + \beta_1 \cdot \frac{D_{t-1}}{E_{i,t-1}} + \delta \cdot \mathbf{Z}_{i,t-1} + \mu_i + \mu_t \cdot \mu_c + \epsilon_{i,t}$$

- **Difference-in-Differences**
  - Estimation of the effect of higher capital requirements in context of the *2011 EBA Capital Exercise*
  - Matching estimator as well as standard DiD Regression is employed

3 Data

- **Cost of Capital Estimates**

Panel A: Distribution of Implied Cost of Capital Estimates

Variable	N	Mean	Min.	p5	p50	p95	Max.	St. Dev.
ICC (Average)	174,784	10.78%	1.36%	5.59%	9.66%	20.00%	41.56%	4.72%
DDM (Pastor)	167,140	10.88%	3.58%	5.58%	9.65%	21.53%	33.11%	4.76%
RIM (CT)	155,215	10.89%	2.26%	5.60%	9.75%	20.23%	46.12%	4.95%
RIM (GLS)	156,012	7.02%	0.29%	2.85%	6.41%	13.93%	25.91%	3.36%
AEG (OJN)	155,033	12.28%	1.90%	6.26%	11.29%	21.38%	43.02%	4.72%
AEG (Easton)	157,729	12.40%	1.99%	5.72%	11.13%	23.28%	46.65%	5.60%
Long-term Growth	174,784	15.25%	2.00%	2.00%	10.00%	50.00%	100.00%	17.92%
Analyst Forecast Bias	153,496	0.001	-0.377	-0.006	0.000	0.010	0.745	0.018

Panel B: Pearson Correlation Coefficients

Variable	ICC (Average)	DDM (Pastor)	RIM (CT)	RIM (GLS)	AEG (OJN)	AEG (Easton)	LT Growth	FBIAS
ICC (Average)	1.000							
DDM (Pastor)	0.921	1.000						
RIM (CT)	0.932	0.929	1.000					
RIM (GLS)	0.625	0.450	0.490	1.000				
AEG (OJN)	0.921	0.846	0.844	0.467	1.000			
AEG (Easton)	0.897	0.758	0.740	0.463	0.883	1.000		
Long-term Growth	0.609	0.725	0.677	0.076	0.556	0.510	1.000	
Analyst Forecast Bias	0.114	0.077	0.106	0.075	0.106	0.142	0.029	1.000

- **Bank Descriptives**

	N	mean	sd	p5	p50	p95
Cost of Equity	61,310	0.108	0.047	0.057	0.097	0.200
Implied Risk Premium	61,310	0.068	0.052	0.010	0.056	0.172
Total Assets (USDbn)	46,722	31.549	51.437	0.422	6.395	163.700
Total Deposits / Total Assets	44,996	0.727	0.149	0.433	0.765	0.891
Total Net Loans / Total Assets	44,094	0.624	0.163	0.286	0.652	0.837
Commercial Loans / Total Assets	28,846	0.124	0.090	0.006	0.105	0.309
Consumer Loans / Total Assets	27,681	0.068	0.071	0.001	0.046	0.198
Loan Loss Provisions / Total Loans	31,447	0.002	0.002	0.000	0.001	0.005
Loan Loss Reserves / Total Loans	37,888	0.016	0.011	0.003	0.014	0.038
Liquidity	28,687	0.247	0.123	0.057	0.236	0.483
Equity Ratio	46,660	0.090	0.060	0.039	0.082	0.145
Tier-1 Ratio	35,134	0.118	0.032	0.072	0.114	0.181
Total Capital Ratio	35,962	0.140	0.032	0.102	0.134	0.202
Leverage (Debt / Equity)	46,712	12.014	4.912	5.810	11.084	22.950
Total Debt / Total Equity	44,949	2.457	2.316	0.242	1.606	8.048
Total Deposits / Total Equity	44,803	9.480	3.567	4.727	8.892	17.013
RWA / Total Assets	27,317	0.690	0.133	0.432	0.706	0.879
CAPM Beta	33,574	0.712	0.538	-0.015	0.650	1.666
FF3 Beta	33,574	0.712	0.486	-0.015	0.717	1.515
Return on Assets	44,675	0.009	0.011	-0.002	0.009	0.019
Std.Dev. of ROA	31,077	0.001	0.001	0.000	0.001	0.003
Return on Equity	43,219	0.099	0.087	-0.024	0.108	0.208
Dividend Payout Ratio	12,926	0.350	0.247	0.000	0.322	0.867

4 Modigliani-Miller and Banks

a) MM Validity across Industries

	(1) Banks	(2) Other Fin.	(3) Non-Fin.
Leverage	4.2778***	30.1070***	20.8291***
	(1.5234)	(4.9025)	(1.3411)
ln(Total Assets)	52.8443***	-25.1763***	-5.7274**
	(9.5740)	(8.8385)	(2.4822)
Book-to-Market	68.1404***	243.0660***	206.0844***
	(9.6854)	(12.7882)	(3.8097)
ICC Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Country-Time FE	Yes	Yes	Yes
Observations	43943	51011	612180
Adjusted R^2	0.8282	0.7851	0.7533

- **Cost of Equity and Leverage**
  - *Expectation:* Distortions to bank debt, which do not exist in other industries, make banks' cost of equity less sensitive to changes in leverage
  - *Finding:* A one unit change in leverage leads to **5-7 times** lower adjustment in the cost of equity of banks than of other firms

b) MM Validity within the Banking Sector

Dissection of Bank Leverage

	(1) MM	(2) MM	(3) MM	(4) MM
Leverage	4.8296***	4.5990**		
	(1.4389)	(1.7872)		
Deposit Leverage			3.2723*	2.6157
			(1.8413)	(2.0347)
Debt Leverage			9.4945***	9.1664***
			(2.5306)	(3.5386)
ICC Controls	Yes	Yes	Yes	Yes
Bank Controls	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes
Country-Time FE	Yes	Yes	Yes	Yes
Observations	45721	26201	43429	26117
Adjusted R^2	0.8215	0.8407	0.8257	0.8406

- **Deposits vs. (Market) Debt**
  - *Expectation:* Due to explicit deposit insurance the cost of equity should be more sensitive to changes in debt leverage than deposit leverage
  - *Finding:* A one unit change in debt leverage leads to **3-4 times** higher adjustment in the cost of equity than a similar change in deposit leverage

Explicit Government Guarantees

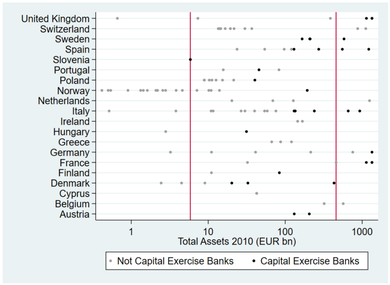
	(1) < p25	(2) p25-p50	(3) p50-p75	(4) > p75
Deposit Leverage	4.8398	-0.0160	4.8580	0.5767
	(3.3697)	(4.7258)	(3.7004)	(3.6209)
Debt Leverage	19.7170***	22.7744***	4.4861	0.9585
	(4.2688)	(7.7503)	(7.1909)	(12.5360)
ICC Controls	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Country-Time FE	Yes	Yes	Yes	Yes
Observations	6577	6338	6670	6650
Adjusted R^2	0.8532	0.7883	0.8378	0.8553

Implicit Government Guarantees

	(1) < 4bn	(2) 4bn-25bn	(3) 25bn-100bn	(4) > 100bn
Deposit Leverage	1.7775	1.0515	8.9078	5.5485
	(3.0937)	(3.2784)	(6.3962)	(5.1447)
Debt Leverage	13.7861**	15.3627***	2.4310	1.8098
	(5.8531)	(5.0000)	(9.7977)	(6.9728)
ICC Controls	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Country-Time FE	Yes	Yes	Yes	Yes
Observations	14080	7330	3103	1860
Adjusted R^2	0.7887	0.8701	0.8995	0.8743

- **Deposit Financing Buckets**
  - *Expectation:* More reliance on deposit financing leads to lower sensitivity to changes in debt leverage
  - *Finding:* (Almost) monotonic increase in sensitivity to changes in debt leverage from highest to lowest deposit financing bucket
- **Size Buckets**
  - *Expectation:* Larger size (TBTF) leads to lower sensitivity to changes in debt leverage
  - *Finding:* (Almost) monotonic increase in sensitivity to changes in debt leverage from largest to smallest size bucket

5 Evidence from a Quasi-Experiment: 2011 EBA Capital Exercise



- **Institutional Background**
  - Announced in October 26, 2011 to restore confidence in and capitalization of the banking sector
  - Included 71 banks such that at least 50% of each EU member state's national banking sector (total assets) is covered
  - Required an increase in core tier-1 ratios from 5% to 9% by the end of June 2012
  - Both timing and magnitude of the increase in capital requirements were unexpected

	(1) Δ CET1 Ratio	(2) Δ Tier-1 Ratio	(3) Δ Total Capital Ratio	(4) Δ Equity Ratio	(5) Δ Log(RWA)	(6) Δ RWA/ TA	(7) ΔIRP
Panel A: Full Sample Matching							
Observations	31	31	31	31	31	31	31
CE Banks	0.0213	0.0187	0.0157	-0.0031	-0.0882	-0.0621	0.0036
Control Banks	0.0095	0.0110	0.0087	0.0015	0.0538	-0.0278	0.01538
Estimator (ATT)	0.0019	0.0098***	0.0118***	-0.0022	-0.2022***	-0.0213***	-0.0328***
Panel B: Overlap Sample Matching							
Observations	22	22	22	22	22	22	22
CE Banks	0.0250	0.0217	0.0179	-0.0033	-0.0811	-0.0736	0.0081
Control Banks	0.1322	0.1204	0.0121	0.0008	0.0430	-0.0296	0.0182
Estimator (ATT)	0.0080**	0.0107***	0.0134***	-0.0072**	-0.1939***	-0.0431***	-0.0248***

- **Banks' Reaction to the increase in Capital Requirements**
  - Treated banks increase their regulatory capital ratios, while their equity ratio does not increase
  - This increase is (mainly) caused by an absolute and relative decrease in risk-weighted assets
  - The subsequent decrease in cost of capital is therefore attributable to lower asset risk rather than increased equity financing

6 Conclusion

- **Banks' cost of equity is less sensitive to changes in leverage**, indicating an **increase in WACC of 10-40bps** (relative increase of 3%-12%) if equity increases from 8% to 16%
- Dissecting bank leverage reveals that **equity investors care more about debt than deposit leverage**
- The **sensitivity towards changes in debt leverage decreases** as the proportion of **deposit financing** or **bank size** increases
- The 2011 EBA Capital Exercise indicates that **increased capital requirements not only affect financing costs but assets composition**

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